of respiration which may be called the catalytic theory. Loew holds that contact with the living proteid, whose intense kinetic energy is predicated, so increases the lability of the CHOH groups in sugars and of the CH_2 groups in the fatty and amido acids that combination with free oxygen follows, to such an extent that these substances are totally oxidized. In the course of this oxidation, the O_2 is split up into its atoms, but not before. By the energy thus set free as heat, appropriate substances may be raised to the labile condition, and other work done. The protoplasm, in rendering the foods labile, suffers a loss of energy, but this loss is again covered by the energy set free in the oxidation. If free O is wanting, the sugar breaks up into other products (fats, lactic acid, etc.), constituting intramolecular respiration. Loew combats vigorously the accepted idea of a continuous dissociation and regeneration of living substance, holding that the impairment involved would be more likely to result in death than in life. For, if the amount of thermogenous foods in a cell becomes considerably diminished, the lability of the plasma proteid leads to its own direct assumption of oxygen; and when only a small part of the proteid has been altered by oxidation, disorganization follows; that is, death by hunger.

The theory of vital energy thus set forth is a consistent one, and is supported by many strong arguments from the chemical side. It is, of course, diametrically opposed to the view which Pflüger and many other physiologists hold, that lability of protoplasm is due to the presence of cyanogen groups (CN), and that respiration is the oxidation of protoplasm itself, at which climax of chemical power it decomposes continuously, to be as continuously rebuilt out of available foods.

There are difficulties in both theories, and physiologists will do well to read and ponder this clear and interesting book by Dr. Loew.—C. R. B.

NOTES FOR STUDENTS.

M. Edmond Gain has endeavored to determine whether the material known as *alinite*, which is recommended for increasing the fertility of the soil through the activity of bacteria, was efficient for this purpose. The active microbe of this product is *Bacillus Ellenbachensis* α (*B. Megatherium* DeBary). His experiments, though not numerous enough to determine the question satisfactorily, indicate that "the addition of alinite produces a beneficial effect, which manifests itself in greater vegetative development of the plants [buckwheat and flax], and in a larger crop of seeds."[5]—C. R. B.

Puriewitsch has determined that the splitting of most glucosides by fungi is accomplished extracellularly, through the splitting action of emulsin, into glucose and benzene derivatives.[6] This action is carried on both by

[5] Revue gén. de Botanique 11: 18–28. 1899.

[6] Berichte der deutsch. bot Gesells. 16: 368. 1898.

germinating spores and by developed mycelium. The glucose produced is first completely used by the plant; the benzene derivatives are then used very much more slowly, if at all. Amygdalin, as attacked by most fungi, forms an exception to the foregoing statement. Though it may be split by emulsin into glucose, benzaldehyde, and hydrocyanic acid, it is usually broken up by invertin into glucose and amygdalic acid, the latter being further decomposed into glucose and mandelic acid.—C. R. B.

SINCE Strasburger's thorough work on *Polygonum divaricatum* (1879) little or nothing has been done with the embryology of any nearly related plant. A recent article on Rumex[7] shows that in this genus the origin and development of the megaspore is the same as in Polygonum, viz: an archesporial cell divides into a primary tapetal cell and a sporogenous cell, the latter giving rise to four megaspores, one of which germinates. The small size of the nuclei makes this rather unfavorable for cytological study, but, judging from the plates, the very clearly defined sequence preceding the formation of the endosperm nucleus (secondary nucleus) indicates that Nawaschin's recent theory could be shown to be inapplicable in this case.—C. J. CHAMBERLAIN.

DR. HANS MOLISCH presented to the Imperial Academy of Sciences in Vienna at the meeting on December 1, 1898, a paper upon "The Secretion of Palm Wine and its Causes." Heretofore the bleeding of the palm when the inflorescence was amputated has been ascribed to root pressure. Three circumstances awaken doubt of this: (1) Were root pressure the cause, it should be observable at the base of the stem; (2) bleeding occurs in the very tall palms, at heights (19–28^{m}) which it is doubtful if root pressure could reach; and (3) bleeding takes place during full leafage.

Researches showed that in Cocos and Arenga root pressure was scarcely to be detected at the base of the stem, and from borings at this point no sap escaped, though it poured out abundantly above. Moreover, a spadix, completely severed, continued to bleed for one or two days and developed a not insignificant bleeding pressure. The osmotic pressure, therefore, according to Molisch, has its origin not in the root but in the axis of inflorescence of Cocos and in the adjacent upper part of the stem in Arenga.[8]—C. R. B.

HERR LIND introduces an article on the penetration of fungi into limestone and bones[9] with a twelve-page summary of the previous work on the

[7] FINK BRUCE: Contribution to the life history of Rumex. Minnesota Bot. Studies. 2:137–153. *pl. 9–12.* 1899.

[8] Cf. Œsterr. bot. Zeits. 49:74. 1899.

[9] LIND, K.: Ueber das eindringen von Pilzen in Kalkstein und Knochen. Jahrb. f. wiss. Bot. 32:603–634. 1898.

subject, from which it is evident that the greatest knowledge has come through dental studies. It has long been known that fungi, algæ, and lichens can corrode or bore into rock, bone, or shell, and it has been assumed that they did this by excreting at the growing tip an acid which dissolved the calcareous material that it touched. Miyoshi in 1895 proved that chemotactic irritation induced the penetration of a cellulose membrane by fungi. Experimental proof of the cause and manner of penetration of calcareous objects seems to appear first in Lind's work. By adopting careful antiseptic precautions, he proves that a fungus may penetrate marble, chalk, eggshell, or bone plates, 0.07 to 0.2^{mm} in thickness, in eight or ten days. To do this there must be a chemotactic stimulus, usually furnished by some organic or inorganic food material that is needed by the plant. The stimulus seems useful to cause the acid-forming surface to be pressed close to the rock in order to secure a sharply localized action. Microscopic examination shows that the fungus may pass directly through crystals. From a study of the action of oxalic and carbonic acids, the author concludes that the latter is primarily responsible for the etching, though oxalic acid may be accessory, especially in the presence of sodium chlorid which may afford hydrochloric acid by combination. The greater prevalence of such perforations in marine than in fresh water shells is thereby explained.— F. L. STEVENS.

ITEMS OF TAXONOMIC INTEREST are as follows: In *Bulletin of the Torrey Botanical Club* **26**: 63–71. 1899) CHARLES H. PECK has described twenty new species of fleshy fungi.— ELIZABETH G. BRITTON (*ibid.* 79–81) has described a new Tertiary moss (Rhynchostegium) which is probably the oldest species yet found in this country.— ANNA MURRAY VAIL (*ibid.* 106–107) continues her studies of the Leguminosæ, presenting the genus Dolicholus (Rhynchosia), with sixteen species.— CHARLES MOHR (*ibid.* 118–121) has described new species of Prunus, Physalis, and Solidago from Alabama.— AVEN NELSON (*ibid.* 122–134) continues his description of new species from Wyoming, the present fascicle containing seventeen species in widely scattered genera. — K. M. WIEGAND (*ibid.* 135–137) has described some new species from Washington, and also (157–171) has published a revision of Listera, including twelve species, seven of them North American, two of which are new.— In *Pittonia* (4 : 25–52. 1899) E. L. GREENE publishes twenty seven new species in miscellaneous genera, the largest number being added to Sisyrinchium (5) and Silphium (4); discusses chronologically early specific types in Chamæcrista as distinct from Cassia, discovers some twenty-three, and transfers them from Cassia to Chamæcrista; brings up certain neglected generic types, recognizes *Phyla* Loureiro for *Lippia* Mx., separates *Sieversia* Willd. from *Geum*, and establishes *Vanclevea* Greene upon *Grindelia stylosa* Eastwood.— Circulars 9 and 10 of the Division of Agrostology contain contributions by LAMSON-SCRIBNER and WILLIAMS, thirteen new species and several new varieties of Poa being described, as well as species in Eragrostis and Elymus.—A continuation of Schinz's (Zürich) work on the African flora appears in *Bull. Herb. Boiss.* (7: 24–65. 1899), the separate being published as *Contrib. Bot. Mus. Univ. Zürich.* The most important papers are as follows: Gramineæ (7 n. spp.), by E. HACKEL; Leguminosæ (12 n. spp. and a new genus *Neorautanenia*), by HANS SCHINZ; and the fourth installment of Convolvulaceæ, by H. HALLIER.—J. M. C.

THE QUESTION of the sexuality of Collema is discussed by Baur[10] who adds some interesting observations to our imperfect knowledge of the peculiar conditions preceding the ascocarp in this form. He confirms Stahl's original observation and gives us a more detailed account of the cytology of the archicarp and trichogyne than has yet been presented. It seems that the cells of the spirally twisted archicarp and the trichogyne which rises from it are in communication with one another by delicate strands of protoplasm that run through a pore in the center of each cross-wall. The entire structure consists of 25–40 cells, 15–20 constituting the archicarp and the remainder making up the multicellular trichogyne. Each cell contains a single nucleus, that in the terminal cell of the trichogyne being slightly larger than the others. Spermatia were observed fused with the projecting tips of the trichogyne.

A medium sized thallus of Collema will produce every season, spring and autumn, many hundreds of archicarps with their trichogynes, but of these less than one per cent mature fruit. The others gradually wither from above downwards, and the basal portions become a part of the vegetative mycelium of the lichen. No spermatia were ever observed attached to withering trichogynes. Sometimes lichen thalli will bear thousands of archicarps, and yet produce no apothecia. Baur believes he has found the explanation in the absence of spermogonia on such specimens. An apothecium lives for several years and the first asci are formed from six to twelve months after fertilization.

Baur's conclusions on the mechanism of fertilization are not final, his paper being in the nature of a preliminary contribution. From observations on several specimens he believes that, as the result of fertilization, the nuclei of the trichogyne gradually become disorganized, beginning from above, until only the cells of the archicarp remain unchanged. Finally all the cells above the archicarp break down. Baur points out two ways in which fertilization might be accomplished. Perhaps the sperm nucleus passes down through the disorganized cells of the trichogyne and fertilizes one or more cells of the archicarp; or it is possible that the sexual act may take place in the terminal cell of the trichogyne, and that a fusion nucleus makes

[10] BAUR: Zur Frage nach der Sexualität der Collemaceen. Ber. d. deut. bot. Gesells. 16: 363. 1898.

its way into the archicarp, giving rise by its activity to the system of hyphæ that constitutes the ascocarp. The last explanation is apparently suggested by Oltmanns' recent work on the Rhodophyceæ.—B. M. DAVIS.

BULLETINS of the experiment stations not heretofore mentioned relating to plant diseases are as follows: "Diseases of plants," by A. P. Anderson S. C., no. 36, pp. 1–17, illust.), gives a brief popular account of the rôle of fungi and bacteria as disease agents. The same author writes upon "The asparagus rust in South Carolina" (S. C., no. 38, pp. 1–10, illust.), while Byron D. Halsted gives more extended observations upon "The asparagus rust, its treatment and natural enemies" (N. J., no. 129, pp. 1–20, illust.). In a "Preliminary report upon diseases of the peach; experiments in spraying peach trees," Aug. D. Selby (Ohio, no. 92, pp. 179–268, illust.) gives a large amount of information with much original observation, to which a serviceable index is added. The same investigator also writes upon "Some diseases of wheat and oats" (Ohio, no. 97, pp. 31–61, illust.) especially of smuts, rust, scab and glume spot. The Fusarium causing scab of wheat is said to be *F. roseum* Lk. The ascigerous stage was found and almost certainly identified as *Gibberella Saubinetii* (Mont.) Sacc. Cultures were made, but attempted infection of living plants was not successful. In an account of "Pea canning in Delaware" by G. Harold Powell (Del., no. 41, pp. 1–16, illust.) is a description (pp. 8–11) of sun scald of peas caused by *Ascochyta Pisi*. A comprehensive treatment of the "Diseases of the tomato" by P. H. Rolfs (Fla., no. 47, pp. 117–153, illust.) recounts practical observations upon the cause and prevention of eleven diseases. Black rot (Macrosporium) is the most prevalent, and can be prevented by spraying with Bordeaux mixture; a bacterial disease is common and less easily controlled; and what is locally known as "white mold," although due not to a fungus but to *Phytoptus Calcladophora* Nal., is not yet reported from any other state. The bulletin is well written and printed, and is a model for a practical treatise. Observations on "Cotton rust" are given by F. S. Earle (Ala., no. 99, pp. 281–309) in addition to previous accounts by Dr. Atkinson. B. M. Duggar (Cornell, no. 163, pp. 339–363, illust.) has studied "Three important fungous diseases of the sugar beet," which are root rot (*Rhizoctonia Betæ* Kühn), leaf spot (*Cercospora beticola* Sacc.) and scab (*Oospora scabies* Thax.). Much original information is given regarding the fungi, the diseases they cause, and remedies, followed by a bibliography. The same author presents important notes on "Peach leaf curl and notes on the shot-hole effect of peaches and plums" (Cornell, no. 164, pp. 371–388, illust.), emphasizing the value of early spraying with Bordeaux mixture for the former, and showing that the latter is often produced by spraying and other non-fungous causes. A concise account, with observations within the state of Vermont, is given by L. R. Jones (Vt., no. 66, pp. 1–16, illust.) of "Club root and black rot, two diseases of the cabbage and turnip," the former mycetozoan and the latter bacterial, both widely distributed and common. "Suggestions as to spraying" by J. A. Tillinghast and G. E. Adams (R. I., no. 52, pp. 1-48, illust.) is a convenient and well prepared handbook of plant diseases amenable to spraying, with directions for the work. It is a more valuable bulletin than the title indicates. An extended report on "Spraying cucumbers in the season of 1898," by F. A. Sirrine and F. C. Stewart (N. Y., no. 156, pp. 375-396, illust.) shows the value of frequent use of Bordeaux mixture during the latter part of the season against *Plasmopara Cubensis*. The advantages and methods in the use of "Formalin for grain and potatoes," especially for smut of oats and wheat and scab of potatoes, are presented by J. C. Arthur (Ind., no. 77, pp. 38-44). The chemical composition of "Some spraying mixtures" has been determined by George W. Cavanaugh (Cornell, no. 149, pp. 719-721). Spraying calendars are issued by the Michigan (Special no. 12) and Ohio (no. 102) stations, the latter being especially complete and convenient.

Copies of the above bulletins may usually be obtained without expense by sending a request to the *Director of the Station*, addressed respectively in the order given above: Clemson College, S. C.; New Brunswick, N. J.; Wooster, Ohio; Newark, Del.; Lake City, Fla.; Auburn, Ala.; Cornell Univ., Ithaca, N. Y.; Burlington, Vt.; Kingston, R. I.; Geneva, N. Y.; Lafayette, Ind.; and Agricultural College, Mich.—J. C. A.

A RECENT paper by Nordhausen on parasitic fungi[11] is of great value. It starts with the scientific conclusions of Miyoshi regarding the penetration of membranes by fungi and extends the work, laying an accurate foundation for the knowledge of the conditions of natural infection of plants by invading fungi. The paper deals with such questions as the method of infection; the influence of the condition of the host upon resistance to infection; the cause of epidemics, etc. Nordhausen experiments with hemisaprophytes, and proves that sporelings, growing in a drop of pure water on the epidermis cannot gain entrance to the plant without nourishment additional to that contained in the spores. However, when injected hypodermically in vessels or pith cavities, they grow and cause death throughout the structure. So it seems that a spore can infect living cells without the intervention of a period of saprophytic existence if unprotected or poorly protected cells are available. It is the epidermis that protects the tissue from invasion. Flower leaves do not have a resistant epidermis, and some most valuable observations were made regarding the effects of spores germinating on petals. A yellow spot marked the position of the spore, and the protoplasm of the adjoining cells was brown even eight hours after the spore had arrived and *before its germ*

[11] NORDHAUSEN, M.: Beiträge zur Biologie parasitarer Pilze. Jahrb. f. wiss. Bot. 33: 1-46. 1899.

tube had entered. This must have been due to a toxin freed during the germination. The author investigated this further and proved that it was a very vigorous substance. The browning of the cell walls precedes death of the protoplasm. The author concludes, from what seems to be ample evidence, that there are two substances produced, an enzyme that browns the wall and digests it, thus producing a soluble substance which attracts the germ tube chemotropically. Later there is a toxin which kills the cell and this affords the fungus a base of supplies for a saprophytic existence. Thereafter it may easily invade surrounding tissues to any extent. Slight humidity favors germination of the spore, but great dampness dilutes the toxin and enzyme; therefore the optimum destruction is at a moderate humidity. The author holds that, even in the case of subepidermal wounds or the hypodermic injection of sugar (Miyoshi), the fungus does not attack live cells, but its saprophytic existence is thus assured while it liberates its toxin; it is also possibly aided by weakening of the resistance of the cell through the unnatural conditions. Many suggestions are made regarding the influence of the condition of the host upon resistance; among them, that normal structure counts for much (*e. g.*, thick epidermis); growing portions are susceptible because thin walled; similarly, great dryness weakens the resistance of the ectoplasm, and lack of light results in a thin wall, etc. The author attributes epidemics largely to climatic conditions, or to a breeding place for the fungus where it may obtain food for its existence as a saprophyte. He explains that in such times any particular host species succumbs probably because it furnishes a foothold in some way for a temporary saprophytic existence of the parasite. Or, a given plant may through its own specific heat cause an exactly favorable amount of dew to be condensed on its surface.

Two more questions are investigated, viz.: Can a representative pure saprophyte (*e. g.*, Penicillium, Mucor) under certain conditions become a parasite? Why are they so seldom parasitic? The first is answered abundantly in the affirmative (*e. g.*, fruit decay). Why they are not often parasites is shown by the fact that they cannot penetrate a live cell, even of the mesophyll, although they can penetrate cell walls and may live among them. Host cells may even live for sometime in contact with the mycelium. It seems, therefore, that these fungi make no toxin, as do the parasites or hemisaprophytes. In the case of wounds the reaction of the plant is important. The host may set to forming parenchyma; then the advance of the fungus will depend upon how much it can hinder this recuperative process. It is fight to the death between the host and the fungus. Botrytis is usually victorious, but not always, as victory is to a certain extent dependent upon the amount of resistance of the host. In the case of saprophytes the host's resistance is more important, as the fight is waged in every cell anew, but to even such fungi, fruits are so slightly resistant as to be an easy prey. It is to be hoped that the author will extend his work to the consideration of the behavior of parasitic fungi.— F. L. STEVENS.

THE ELABORATE MONOGRAPH on starch published a few years ago by Meyer is now followed by a comprehensive account of the state of knowledge regarding inulin and carbohydrates of somewhat similar nature which occur in many plants.[12] Dr. Hugo Fischer gives in the first half of this paper an account of the chemical nature of inulin. Like most of the polysaccharides the composition of its molecule is not known. It is built up of fructose units, but the number of molecules of fructose in each molecule of inulin is not known, and the suggestions vary within wide limits. The low osmotic pressure of solutions of inulin indicate that the molecule is very large. Several modifications of inulin have been described, but the independent existence of these as chemical individuals is not demonstrated. It is possible that some of them (perhaps all) are decomposition products of inulin.

Fischer describes the formation of the spheroidal masses of inulin in plant tissues and compares with these the other spheritic structures occurring in plants, particularly hesperidin (a glucoside occurring in Citrus rind) and calcium phosphate or malophosphate. The latter includes a nucleus of non-crystalline material (perhaps containing proteid). In its spheritic form inulin resembles starch grains in many ways, particularly in swelling upon the imbibition of water at ordinary temperatures and in double refraction. Inulin, however, does not swell like starch, on the application of hot water, alkalies, etc., but dissolves like soluble crystals or breaks up into granules which dissolve.

In the last part of his paper Fischer describes the occurrence of inulin, gives a list of the plants in which it has been found (about 140 species, including 95 Compositæ, about 25 species of allied families, a half dozen Violaceæ, two monocotyledons, and a few algæ), and discusses the methods and places of manufacture, transportation. and storage.

The most important theoretical part of this monograph is the discussion of the structure of inulin masses and starch grains, particularly in view of the trichite theory of the structure of starch grains proposed by Meyer. Meyer held that the swelling of starch was *due* to the spheritic structure, ignoring the facts that many spherites do not swell and that many bodies which do swell are non-spheritic. Fischer shows that when starch grains are air dry (still, however, containing 20 per cent. of water), this water is not free, since it does not indicate its presence by a test with cobalt chloride. Both inulin and starch absorb certain solutions of coloring matters. Did these solutions enter into the spaces between the crystals, as Meyer holds, all should be alike absorbed. But some coloring substances do not penetrate. To explain this it would be necessary to assume that their molecules were large enough to

[12] COHN's Beiträge zur Biologie der Pflanzen 8 : 53–10. 1899.

approach the limit of visibility, since the trichites are, according to Meyer, so slender as to approach this limit. This is, of course, an absurd assumption. Fischer shows also that the storing of colors is difficult or impossible to explain on the crystal-trichite theory. It is well known, however, that colloids and even liquids (*e. g.*, clove oil) are able to store up coloring matter, but no crystals are known which do this. Moreover, starch and inulin which have been stained while wet and then air-dried cannot be decolorized by alcohol or clove oil. It is impossible to understand why alcohol cannot penetrate between the trichites and withdraw the coloring matter, since, even, in the air-dry condition, there is still 20 per cent. of water around the trichites. The relations of starch to iodine, also, are difficult to explain on Meyer's theory. Only when wet does starch give the well-known blue reaction with iodine; dry grains react brown. When blue grains are air-dried they become brown. To explain this upon the crystal theory would require us to assume that when the trichites are surrounded by a little water the iodine solution is brown, but when the crystals are surrounded by a larger quantity of water it is blue; again, an impossible assumption.

Fischer also criticises Bütschli's theory of "foam" structure for bodies capable of swelling, in which an attempt is made to explain the force developed by imbibition by osmotic action of the substance occupying the "bubble" spaces. His own view, stated very briefly, is that both in starch and inulin a true chemical relation exists between water and the molecules of amylose and inulin, in consequence of which the molecular structure is different according as greater or less quantities of water are present, after the analogy of some crystals. Watery amylose and inulin have different physical properties from those they possess when air-dry. Only in the watery condition can they dissolve in their own substance and store certain coloring matters; others are insoluble. Iodine, whose tints differ according to the solvent, is dissolved in watery amylose with a blue tint. When air-dry the iodine is not in solution, but is distributed through the amylose in fine solid particles.

Swelling, Fischer holds, is thus a purely molecular process—a loose combination of molecules with water after the fashion of water of crystallization in some salts. Upon an increase of water this condition passes without break into the state known as solution, that is, a still looser relation of the molecules to water. The fact that imbibition occurs for inulin, starch, cellulose, gums, gelatin, etc. only with water, supports this view. The radial structure of both starch and inulin spherites is explicable as due to radial cracking. These cracks are exceedingly minute in starch and into them the air does not enter. They are larger in inulin spherites and are penetrated by air. The double refraction of both bodies is due to the strains under which the masses exist; strains which are not completely relieved in starch until the expansion due to true imbibition has passed over into the semi-solution of the gelatinous state. Both inulin and starch grains are thus considered to be masses of colloid, homogeneous, except for the radial cracks. The material is arranged in layers or zones arising from internal differentiation.—C. R. B.

Among annual reports from experiment stations, not heretofore noticed in these pages, are three from the New York station. Those for 1895 and and 1896, much delayed in appearing, have about one third the space devoted to the reports of the horticulturist, S. A. Beach, and mycologist, F. C. Stewart, and their assistants. The more strictly botanical portion in the 1895 report covers about 70 pages, dealing with fungous diseases and their remedies, with fine excellent plates, and in the 1896 report there are 100 pages and ten fine plates. A part of this matter had been published elswhere. In the 1897 report no botanical matter appears that had not already been issued in bulletin form.

The report of the Rhode Island station for 1897 contains an article on use of sulfur and sulfate of Ammonia for prevention of potato scab (pp. 254–268) by H. J. Wheeler and G. E. Adams, showing that both substances have some value; and also an article on the asparagus rust (pp. 317–321) by L. F. Kinney, giving an account of a serious outbreak at Concord, Mass., the spread of the disease in Rhode Island, and attempts to control it.

The report of the Maine station for 1897 contains a valuable résumé of important writings on the acquisition of atmospheric nitrogen (pp. 114–140) by W. M. Munson, in which he cites both foreign and American literature, and appends a bibliography of 120 numbers. F. L. Harvey writes upon plants of the season (pp. 179–191), especially the weeds about which inquiries have been made, the king-devil (*Hieracium prœaltum* Vill.) receiving most attention, including its history, distribution in America, habits and methods of prevention. The blighting effect of wind on maple leaves in spring is described, and some diseases are mentioned. Three species of stinkhorn fungi have been found in the state, *Phallus dæmonum* Rumple, *P. impudicus* L. and *Mutinus brevis* B. & C., which are described with the aid of a half-tone plate from a photograph of the first two.

In the report of the Delaware station for 1896–7 F. D. Chester gives an account of experiments for prevention of peach rot and apple scab by spraying, and of potato scab by use of sulfur (pp. 20–38), and also proposes a systematic arrangement of the species of the genus Bacterium (pp. 53–145), giving diagnostic characters and providing a bibliographic index.

The Hatch station of Massachusetts for 1897 devotes 24 pages (pp. 47–70) and two good plates to the report of the botanists, G. E. Stone and R. E. Smith. The subjects covered are the value of spraying, potato maladies of the year, "drop" of lettuce (*Botrytis*), asparagus rust (*Puccinia Asparagi*), fire blight of pears, quince rust (*Gymnosporangium clavipes*), brown rot of stone fruits (*Monilia fructigena*), chrysanthemum rust (*Puccinia Tanaceti*), a bacterical disease of the geranium, and four leaf blights of native trees.

The last report issued by the California station, being for 1895–1897, includes an account of the natural vegetation of alkali lands (pp. 63–75) by J. Burtt Davy, illustrated with eight fine plates from photographs. The plates show *Frankenia grandifolia campestris* Gr., *Distichlis spicata* (L.) Greene, *Atriplex polycarpa* (Torr.) Wats., *Bigelovia veneta* (H. B. K.) Gr., *Sucæda* Torreyana Wats., *Sporobolus airoides* Torr., *Allenrolfea occidentalis* (Wats.) Kuntze, and *Modiola decumbens* Don.

The report of the Connecticut station for 1897 is issued in parts, and part three (pp. 159–222) is entirely devoted to botany. The articles are by W. C. Sturgis, and present, with much fullness, a study of the mildew of lima beans (*Phytophthora Phaseoli* Thax.), stem rot of carnations, which was found to be due to a Fusarium, prevention of fungous diseases of celery and apple, and an extended classified index to the literature of fungous diseases, found chiefly in the publications of the U. S. Department of Agriculture and the state experiment stations.

The Arizona report for 1897–8 is very brief, containing only 40 pages. The botany (pp. 160–169) by J. W. Toumey treats especially of root-rot of Alfalfa, and sunburn of fruit trees, the latter being due to the action of a hot sun while the plants are in a wilting condition.

In the Wisconsin report for 1897–8 there are two important botanical studies by E. S. Goff. The first is an investigation of the resumption of root growth in spring (pp. 220–228), showing that the rootlets of trees and shrubs do not die away during winter, as usually taught, but that growth is resumed in spring where it ceased in the previous autumn. The second is a study of the morphology and habits of the strawberry plant (pp. 229–238). Both are well illustrated by cuts.

In the Vermont report for 1897–8 both the botanist and horticulturist write upon subjects that are largely botanical. The botanists, L. R. Jones and W. A. Orton, present a variety of topics (pp. 189–236). Valuable results are recorded in spraying potatoes and apples for fungous diseases, and in treating potatoes, especially with formalin, for scab. In 1897 the asparagus rust and club-root of cabbage were first reported in the state. A list of the parasitic fungi of the state with their hosts includes 17 species of Phycomycetes, 27 of Erysipheæ, 15 of Ustilagineæ, and 80 of Uredineæ. There are interesting observations on weeds, and on impurities in clover seed. A study of the flow of maple sap shows close correspondence between changes of temperature and rates of flow, and by use of lithium it was found that the sap flowed equally well up or down the trunk, but very slowly in a radial direction. F. A. Waugh, the horticulturist, reports (pp. 237–306) with great fullness upon the study of plums, their pollination, self-sterility, hardiness, and blossoming seasons, to which is added a monograph of the Wayland group of plums, all amply illustrated. There are also notes on lilies, on physiological constants, on use of enzyms in germination, and on winter-killing of buds, all treated with originality, and full of valuble facts.—J. C. A.

In *Journal de Botanique* 13: 127, M. Ph. Van Tieghem proposes to discriminate the non-sexual reproductive bodies now called spores into three categories. (1) The term *spores* he retains for those bodies which are formed by an adult plant and develop into a new "adult" individual. All the fungi and most of the algæ form spores; the gemmæ or brood-buds of bryophytes are spores; but no vascular plants produce spores. (2) The term *diodes* (from δίοδος, passage = transition) is suggested for reproductive bodies, arising on the adult, which develop into a "rudimentary" body, the prothallium thus establishing a transition between the "adult" and "rudimentary" stages. Thallophytes and bryophytes have no diodes; they are peculiar to vascular plants. The diodes may be all alike (isodiody), or differentiated into microdiodes and macrodiodes (heterodiody). (3) All the bryophytes, the Rhodophyceæ and Mucoraceæ produce and set free viable cells which are not spores, because they do not arise from the adult stage, and not diodes, because they produce directly an adult individual. To them is given the name *tomies*, from τομή, to cut, because by them the total development from the egg is "cut" into two unequal parts, the smaller preceding the tomies, the larger following their growth. The rudimentary structure in which they are formed is the tomiogone.

The application of these new terms is obvious enough, but to the writer they seem worse than useless because they obscure homologies—which is also obvious enough.—C. R. B.